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Montgomery states that two species are as distinct in the egg-cell stage as in any later one, "no matter whether the differences are as perceptible or not."[1] Such a statement, however, evades the question whether or not embryos of related species can actually be distinguished from one another.

The four suborders of rodents, represented by the squirrel, mouse, guinea pig, and rabbit respectively, according to Lee may be distinguished at very early stages. His studies do not enable him as yet to recognize the genera of one suborder,— namely the gophers, prairie dogs, squirrels, and chipmunks — until the embryos are far advanced. Differences in tunicate eggs of closely related genera have, however, been recorded by Conklin, and McClung can distinguish several species in one genus of grasshoppers by the chromosomes of their germ cells.

F. T. L.

ZOOLOGY

New Text Books of Zoology.— The most important service that biology can render to students is to train their reason and their power of observation, and to free them from a too deep reverence for authority. This service can also be performed by the other natural sciences, physics and chemistry, which are commonly included in the curricula of high schools but which require expensive apparatus beyond the reach of many schools. Biology, however, can be profitably taught with so slight an equipment that every school can afford to undertake to teach botany or zoology, or both. The teaching of biology has often failed to yield the results that educators have expected. This is so because teachers too often yield to the temptation to tell the students the facts and theories which they ought to learn by their own efforts, instead of teaching them how to discover, to classify, and to draw proper conclusions.

Professor Glenn W. Herrick, of the Mississippi Agricultural College has endeavored to meet the needs of the high school of limited means whose students will, as a whole, have no further instruction in biology. He presents to such students a laboratory guide containing directions for the examination (we can scarcely say for the dissection) of something more than twenty species of vertebrates and invertebrates, together with questions, the majority of which appear to be answered by the context, the remainder by the companion text book.[1] This method seems to us unwise and the book is apparently less useful than Kingsley's *Elements of Comparative Zoology* (2nd. ed., Henry Holt and Co., 1904). The latter is a cheaper book which gives facts that are otherwise inaccessible to the student and asks questions which can be answered without appeal to costly apparatus, about easily obtained and inexpensive animals. The answers, the student must gather while learning both to find and arrange facts and to draw right conclusions. A more extensive work is that of Linville and Kelly; their *Text Book in General Zoology* and *Guide for Laboratory and Field Work in Zoology* (Ginn. and Co., 1906) give facts and suggestions, especially for the reading of original articles, together with necessary deductions; and ask most interesting and suggestive questions which the student must answer from his own work. The conscientious use of any of these books will give the student about the same facts, but Kingsley, and Linville and Kelly, compel the student so far as a book can do so, to observe and think, which is the most desirable service to the memory-laden youth. It really makes little difference how many facts are given to a student, whatever his future may be; the method of study is of primary importance.

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[1] Montgomery, T. H. The analysis of racial descent in animals. New York, Henry Holt and Co., 1906. p. 192.

Some of Professor Herrick's diagrams are not wholly correct. For example Fig. 70, which is very much like the excellent figure of a male crayfish in McMurrich's *Invertebrate Morphology* (Fig. 168), is labelled as a female. It is the sperm duct, and not the oviduct as in Herrick's figure, which opens at the base of the last thoracic limb. The following statement from page 33 of the text book is an example of defective fact and theory,— " It may seem strange that the oldest animals (Protozoa) are the simplest, but it is true. It is probably due to the fact that these animals have always lived in the water and the water is probably not very different today from what it was ages ago. Hence there has been nothing to bring about change in these animals, and they have remained much the same." It is needless to say that Protozoa or even Amoebae are not confined to the water and that very many highly developed animals have been evolved in water.

For more advanced students Dr. Gilman A. Drew, Professor of

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[1] Herrick, G. W. *Laboratory Exercises in General Zoology.* New York, American Book Company, 1907. 12mo., 110 pp. 60 cents.

Herrick, G. W. *Text Book in General Zoology.* New York, American Book Company, 1907. 12mo., 386 pp. $1.20.

Biology at the University of Maine, has written a *Laboratory Manual of Invertebrate Zoology*.[1] This book is essentially like Bumpus' *Laboratory Course in Invertebrate Zoology*, the first edition of which appeared fifteen years ago, and both are the result of the teaching of zoology at the Marine Biological Laboratory at Woods Hole. The later book, however, differs from the earlier in the addition of tables of classification, an index and a glossary, as well as in the number and length of the directions for dissection.

The second edition of Bumpus' book (1893) gives directions for the dissection of 31 species in 141 pages, while Drew deals with 90 species in 174 pages or, if we exclude the 16 pages devoted to classification, in 158 pages.

This large increase in the number of species without a corresponding increase in the size of the book does not indicate superficiality, as might reasonably be inferred, but is due to the desire to show the student something of the range of modifications in structure and of the marvellous adaptation to environment found among invertebrates. A good example of this is seen in the treatment of the annelids. Nereis and Lumbricus are each given a moderately full description: the specialization of the swimming and sensory organs are emphasized in the former; the nephridia, reproductive organs and musculature in the latter. Other genera show budding; the formation of scales, tubes and shells of various form and material; types of gill; and the differentiation of the body into two or three regions. This is really splendid and we hope that our fear is unwarranted that internal anatomy is given too small a place. This fear is in a measure justified by the fact that the coelom of echinoderms is not mentioned, that of mollusks is indicated only by references to the pericardium and, in the squid, to the ovary "inclosed in a capsule from which the oviduct leads."

The wealth of living material demanded by the book ought to limit its use to marine stations or to schools near the ocean. The glossary is not perfect but is useful. The term nephridium is not defined and the excretory organ of molluscs, which is a nephridium, is called in the text a kidney; and the definition of the kidney is,— "Frequently applied to the excretory organ of an invertebrate." The hypophysis is defined as "a ventral projection from the brain of Chordata."

The book has excellent features and in the second edition which will be demanded soon, minor faults will be eliminated. The book will probably serve another decade as well as Bumpus' book has served students of zoology for the past ten years.

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[1] Drew, G. A. *A Laboratory Manual of Invertebrate Zoology*. Philadelphia, W. B. Saunders Co., 1907. 12mo., 201 pp. $1.25.

LEONARD W. WILLIAMS

Books of Nature Study.— The American Book Company is issuing a series of "Eclectic Readers" for lower grammar school grades. These include *The Trail to the Woods*[1] by Clarence Hawkes, and *Half Hours with Mammals*,[2] by Charles F. Holder. The former is chiefly a collection of hunting stories. It tells of foxes who "stop a moment to consider" and who have learned to place a wounded foot in cold water "to draw out fever and pain." With the humanizing of the foxes there is a cold-blooded account of their destruction — "As the club said, 'They were just old enough to play nicely.' By seven o'clock the pelts of two of them were dangling from the pockets of lucky hunters." This is not good reading for children.

The book by Dr. Holder in some respects suggests Wood's Natural History. It is intended for intermediate grades. The student is advised not to accept the reports of "honest men and women" who impart to animals such traits as "would astonish the bear, fox and others could they read the English language"; but the author states that animal intelligence differs from human intelligence only in degree. His frequent references to his own observations, particularly of Californian animals, form a considerable part of the book. Of the gopher he says,— "I have seen my favorite carnations waving wildly as though an earthquake was shaking them. Then the stalk and flower would disappear, being hauled down into the burrow and eaten." The Reader is fully and attractively illustrated.

Pictures from Nature's Garden[3] is an English book comparable with Bigelow's *Spirit of Nature Study*. It contains reminiscences and stories about children and butterflies, the author being very fond of both. Several of the photographic illustrations refer to mimicry and protective adaptations, which the reviewer believes are interpreted with the simplicity which led Topsy, as described on page 38, to confound frogs' eggs with tapioca pudding. To justify the child's mistake the author presents a photograph of both. After an interesting descrip-

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[1] Hawkes, Clarence. *The Trail to the Woods.* New York, American Book Company, 1907. 12mo, 176 pp., illus.

[2] Holder, Charles F. *Half Hours with Mammals.* New York, American Book Company, 1907. 12mo, 253 pp., illus.

[3] Shepheard-Walwyn, H. W. *Pictures from Nature's Garden.* London, John Long, 1907. 8vo, 311 pp., illus. 6 s.